

GASOLINE VAPORS

CAS Registry Number: NA

Gasoline vapors consist of alkanes, alkenes, and aromatics. Alkanes make up approximately 89 percent of gasoline vapors, and alkenes and aromatics make up 8 percent and 2 percent, respectively. Butane, isopentane, isobutane, pentane, and propane are the top five constituents of gasoline vapors (ENVIRON, 1990).

SOURCES AND EMISSIONS

A. Sources

Sources of gasoline vapors include refineries, bulk terminals, bulk plants, service stations, motor vehicles, and home storage and use.

The primary stationary sources that have reported emissions of gasoline vapors in California are businesses engaged in wholesale trade in petroleum and petroleum products, pipelines (except natural gas), and petroleum refining facilities (ARB, 1997b).

B. Emissions

The total emissions of gasoline vapors from stationary sources in California are estimated to be at least 6,100,000 pounds per year, based on data reported under the Air Toxics “Hot Spots” Program (AB 2588) (ARB, 1997b).

C. Natural Occurrence

No information about the natural occurrence of gasoline vapors was found in the readily-available literature.

AMBIENT CONCENTRATIONS

No Air Resources Board data exist for ambient measurements of gasoline vapors. Northeast States for Coordinated Air Use Management (NESCAUM) estimated exposure to gasoline from 3 scenarios: 1) for a self-service customer at a gas station exposed via inhalation, the mean exposure dose would be 9.4×10^{-3} milligrams per kilogram per day (mg/kg/day); 2) for a gas station attendant exposed via inhalation, the mean exposure dose would be 1.8 mg/kg/day;

3) for a resident living downwind of a gas station exposed via inhalation, the mean exposure dose would be 3.1×10^{-3} mg/kg/day (NESCAUM, 1989).

INDOOR SOURCES AND CONCENTRATIONS

A southern California study found that concentrations of compounds directly related to motor vehicle emissions including benzene, toluene, xylene, ethylene dibromide, ethylene dichloride, and lead are 2 to 4 times higher within commuting vehicles than they are outdoors (Shikiya et al., 1989).

A Raleigh, North Carolina study measured volatile organic compounds (VOCs) within vehicles during the summer of 1988. Isopentane, n-butane, and n-pentane were the three most abundant aliphatic VOCs with median concentrations of 52.6, 36.1, and 19.4 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$), respectively. Among the aromatic VOCs, toluene, m-/p- xylene, and 1,2,4-trimethylbenzene were the three most abundant species. Median in-vehicle concentrations for these compounds were 43.1, 29.4, and 14.5 $\mu\text{g}/\text{m}^3$, respectively. The median in-vehicle concentrations of 1,3-butadiene and benzene, were 2.9 and 10.7 $\mu\text{g}/\text{m}^3$, respectively. VOCs measured within vehicles ranged from about 2 to 12 times higher than the ambient concentrations measured at fixed monitoring sites along the driving routes (Chan et al., 1991a).

ATMOSPHERIC PERSISTENCE

Information concerning the atmospheric persistence on the components of gasoline vapors can be found in the compound summaries for some of the individual components.

AB 2588 RISK ASSESSMENT INFORMATION

The Office of Environmental Health Hazard Assessment reviews risk assessments submitted under the Air Toxics “Hot Spots” Program (AB 2588). Of the risk assessments reviewed as of April 1996, gasoline vapors represented the principal cancer risk in 15 of the approximately 550 risk assessments reporting a total cancer risk equal to or greater than 1 in 1 million, and contributed to the total cancer risk in 74 of these risk assessments. Gasoline vapors also represented the principal cancer risk in 6 of the approximately 130 risk assessments reporting a total cancer risk equal to or greater than 10 in 1 million, and contributed to the total cancer risk in 27 of these risk assessments (OEHHA, 1996a). Many more facilities reported cancer risks on the basis of the benzene content of gasoline vapor emissions.

For non-cancer health effects, gasoline vapors contributed to the total hazard index in 8 of the approximately 89 risk assessments reporting a total chronic hazard index greater than 1 (OEHHA, 1996b).

HEALTH EFFECTS

Probable routes of human exposure to gasoline vapors are inhalation, ingestion, and dermal contact.

Non-Cancer: Effects are similar for various blends of gasoline. The vapor acts as a central nervous system depressant, and an eye and throat irritant. Short-term exposures may cause headache, confusion, incoordination, facial flushing, slurred speech, blurred vision, dizziness, nausea, vomiting, and diarrhea. In high concentrations, gasoline vapor may cause unconsciousness, coma, and possible death resulting from respiratory failure. Adverse effects on the pancreas, liver, kidney, and spleen may also occur at high concentrations (HSDB, 1995; Sittig, 1981).

A chronic non-cancer Reference Exposure Level (REL) of $2.1 \times 10^3 \mu\text{g}/\text{m}^3$, is listed for gasoline vapors in the California Air Pollution Control Officers Association Air Toxics "Hot Spots" Program, Revised 1992 Risk Assessment Guidelines. The toxicological endpoints considered for chronic toxicity are the central nervous and respiratory systems (CAPCOA, 1993). The United States Environmental Protection Agency (U.S. EPA) has not developed a Reference Concentration (RfC) or an oral Reference Dose (RfD) for exposures to gasoline vapors (U.S. EPA, 1995a).

Cancer: Gasoline contains varying amounts of benzene, which is a known human carcinogen (HSDB, 1995). Animal cancer bioassays have been conducted using vaporized whole gasoline. Unleaded gasoline vapors are classified by the U.S. EPA in Group B2: Probable human carcinogen, based on sufficient animal evidence and inadequate human evidence (U.S. EPA, 1995a). The International Agency for Research on Cancer has classified gasoline vapors in Group 2B: Possibly carcinogenic to humans (IARC, 1991a).

The State of California has determined under Proposition 65 that unleaded gasoline (wholly vaporized) is a carcinogen (CCR, 1996). The preliminary recommended potency value for use in cancer risk assessments is 1.6×10^{-6} (microgram per cubic meter)⁻¹. In other words, the potential excess cancer risk for a person exposed over a lifetime to $1 \mu\text{g}/\text{m}^3$ of gasoline vapors is estimated to be no greater than 1.6 in 1 million (CAPCOA, 1993).

